AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Claim 1 (Currently Amended): A method comprising:

rendering a digital representation of a dental arch within a three-dimensional (3D) environment;

~~computing a location of a planar guide with the 3D environment based on a placement of an orthodontic appliance within the 3D environment relative to the dental arch;~~ and

displaying the planar guide ~~at the computed location~~ within the 3D environment as a visual aid to a practitioner in ~~adjusting~~ the placement of an orthodontic appliance relative to the dental arch, wherein displaying the planar guide comprises rendering the planar guide at a location that is based on a position of the orthodontic appliance within the 3D environment.

Claim 2 (Original): The method of claim 1, wherein displaying a planar guide comprises displaying the planar guide proximate a tooth of the dental arch to aid the practitioner in placement of the orthodontic appliance on the tooth.

Claim 3 (Original): The method of claim 2, wherein displaying a planar guide further comprises generating the planar guide within the 3D environment relative to a coordinate system associated with the orthodontic appliance.

Claim 4 (Currently Amended): A ~~The~~ method ~~of claim 2,~~ comprising:

rendering a digital representation of a dental arch within a three-dimensional (3D) environment;

positioning an orthodontic appliance at a position within the 3D environment in response to input from a practitioner; and

displaying the planar guide within the 3D environment as a visual aid to the practitioner in adjusting the placement of the orthodontic appliance relative to the dental arch within the 3D environment,

wherein displaying a planar guide ~~further~~ comprises:

rendering the planar guide at a location within the 3D environment that is based on the position of the orthodontic appliance; and

automatically adjusting the location and an orientation of the planar guide within the 3D environment as the practitioner adjusts the placement of the orthodontic appliance with respect to the tooth within the 3D environment.

Claim 5 (Original): The method of claim 1, wherein the planar guide comprises a mesial planar guide, and displaying a planar guide further comprises rendering the mesial planar guide and a distal planar guide parallel to a midsagittal plane of the orthodontic appliance.

Claim 6 (Original): The method of claim 5, wherein rendering a mesial planar guide and a distal planar guide further comprises rendering the mesial planar guide and the distal planar guide parallel to and equidistant from the midsagittal plane of the orthodontic appliance.

Claim 7 (Original): The method of claim 1, wherein the planar guide comprises an occlusal planar guide, and displaying a planar guide further comprises rendering the occlusal planar guide parallel to a midlateral plane of the orthodontic appliance and proximate an occlusal surface of a tooth of the dental arch.

Claim 8 (Original): The method of claim 1, wherein the planar guide comprises a midlateral planar guide, and displaying a planar guide further comprises rendering the midlateral planar guide parallel to a midlateral plane of the orthodontic appliance.

Claim 9 (Original): The method of claim 1, wherein the planar guide comprises a midfrontal planar guide, and displaying a planar guide further comprises rendering the midfrontal planar guide parallel to a midfrontal plane of the orthodontic appliance.

Claim 10 (Original): The method of claim 1, wherein the planar guide comprises a midsagittal planar guide, and displaying a planar guide further comprises rendering the midsagittal planar guide parallel to a midsagittal plane of the orthodontic appliance.

Claim 11 (Original): The method of claim 1, wherein the planar guide comprises a gingival planar guide, and displaying a planar guide further comprises rendering the gingival planar guide parallel to a midlateral plane of the orthodontic appliance and proximate a gingival edge of a tooth of the dental arch.

Claim 12 (Original): The method of claim 1, wherein displaying a planar guide further comprises displaying the planar guide as a semi-transparent two-dimensional plane within the 3D environment.

Claim 13 (Original): The method of claim 1, wherein displaying a planar guide further comprises displaying the planar guide as a partial plane comprising at least two lines within the 3D environment.

Claim 14 (Original): The method of claim 1, further comprising:

displaying the planar guide as a first planar guide having a first color; and

displaying a second planar guide within the 3D environment with a second color different from the first color.

Claim 15 (Original): The method of claim 14, further comprising adjusting the first color and the second color in response to input from the practitioner.

Claim 16 (Original): The method of claim 1, further comprising adjusting a transparency of the planar guide based on input from the practitioner.

Claim 17 (Original): The method of claim 1, further comprising displaying the planar guide as opaque or invisible based on input from the practitioner.

Claim 18 (Original): The method of claim 1, further comprising:

storing data that describes attributes for types of orthodontic appliances that may be selected by the practitioner, and

controlling the display of the planar guide based on the stored attributes for the types of orthodontic appliances.

Claim 19 (Original): The method of claim 18, wherein storing attributes for types of orthodontic appliances comprises storing one or more of dimensions, slot locations, torque angles, and angulations for the types of orthodontic appliances.

Claim 20 (Original): The method of claim 1, further comprising:

storing planar guide data that specifies types of planar guides;

receiving input from the practitioner enabling the display of at least one or more the types of planar guides; and

displaying the planar guide in accordance with the selected one or more types of planar guides.

Claim 21 (Original): The method of claim 1, further comprising:

storing planar guide data that describes attributes for different types of planar guides, and

displaying the planar guide in accordance with the stored attributes for the different types of planar guides.

Claim 22 (Original): The method of claim 21, wherein storing planar guide data comprises storing attributes for the different types of planar guides with respect to different types of orthodontic appliances.

Claim 23 (Original): The method of claim 21, wherein storing planar guide data comprises storing attributes for the different types of planar guides with respect to different types of teeth within the dental arch.

Claim 24 (Original): The method of claim 21, wherein storing planar guide data comprises storing attributes that specify distances for each of the different types of planar guides with respect to at least one of a tooth of the dental arch, a different one of the planar guides, and the orthodontic appliance.

Claim 25 (Original): The method of claim 21, wherein storing planar guide data comprises storing attributes that specify shear angles and scales for the different types of planar guides.

Claim 26 (Original): The method of claim 1, further comprising automatically scaling the planar guide within the 3D environment to size the planar guide based on one or more dimensions of a tooth within the dental arch.

Claim 27 (Original): The method of claim 1, further comprising automatically shearing the planar guide in accordance with a shear factor that is based on an angulation associated with the orthodontic appliance.

Claim 28 (Original): The method of claim 27, wherein automatically shearing the planar guide comprises automatically shearing the planar guide in accordance with an angle of the orthodontic appliance relative to an occlusal-gingival axis of the orthodontic appliance.

Claim 29 (Original): The method of claim 1, further comprising:

storing data defining one or more rules for placing the orthodontic appliance; and

controlling the planar guide to assist the practitioner in positioning the orthodontic appliance in accordance with the placement rules.

Claim 30 (Original): The method of claim 29, further comprising automatically rendering the planar guide within the 3D environment as parallel to a midsagittal plane of the orthodontic appliance in response to one of the placement rules that requires a longitudinal or occlusal-gingival axis of the orthodontic appliance be aligned with the midsagittal plane of the tooth.

Claim 31 (Previously Presented): The method of claim 1, further comprising:

storing statistical normal distances for one or more dimensions of teeth; and

rendering the planar guide at the location within the 3D environment based on the statistical normal distances.

Claim 32 (Original): The method of claim 31, further comprising:

receiving input biasing the planar guide relative to the statistical normal distance; and

adjusting the location for the planar guide based on the input.

Claim 33 (Original): The method of claim 1, further comprising displaying visual reference markers relative to the planar guide at discrete intervals.

Claim 34 (Original): The method of claim 33, wherein displaying visual reference markers comprises displaying a rectilinear grid of semi-transparent lines on the planar guide.

Claim 35 (Original): The method of claim 33, wherein displaying visual reference markers comprises displaying points, crosshairs, tic marks, discs, squares, or spheres at the discrete intervals.

Claim 36 (Original): The method of claim 33, wherein displaying visual reference markers comprises displaying the visual reference markers throughout a volume bounded by the planar guide and at least one other planar guide.

Claim 37 (Original): The method of claim 1, further comprising displaying contour lines on the planar guide, wherein each contour line indicates a constant distance to an object within the 3D environment relative to the planar guide.

Claim 38 (Original): The method of claim 1, wherein the orthodontic appliance comprises an orthodontic bracket, a buccal tube, a sheath, a button or an arch wire.

Claim 39 (Currently Amended): A system comprising:

a computing device; and

modeling software executing on the computing device, wherein the modeling software comprises:

a rendering engine that renders a digital representation of a dental arch within a three-dimensional (3D) environment,

~~a guide control module that computes a location of a planar guide based on a placement of an orthodontic appliance within the 3D environment relative to the dental arch,~~ and

a user interface that displays ~~the~~ a planar guide ~~at the computed location~~ within the 3D environment as a visual aid to a practitioner in ~~adjusting~~ the placement of an orthodontic appliance relative to the dental arch within the 3D environment, wherein the rendering engine renders the planar guide at a location based on a position of the orthodontic appliance within the 3D environment.

Claim 40 (Currently Amended): The system of claim 39, wherein the modeling software comprises a guide control module that controls the location of the planar guide within the 3D environment.

Claim 41 (Previously Presented): The system of claim 40, wherein the guide control module locates the planar guide proximate a tooth of the dental arch within the 3D environment to aid the practitioner in adjusting the placement of the orthodontic appliance on the tooth.

Claim 42 (Original): The system of claim 40, wherein the guide control module generates the planar guide within the 3D environment based on a coordinate system associated with the orthodontic appliance.

Claim 43 (Previously Presented): The system of claim 40, wherein the guide control module automatically adjusts the location and an orientation of the planar guide within the 3D environment as the practitioner adjusts the placement of the orthodontic appliance with respect to the tooth within the 3D environment.

Claim 44 (Original): The system of claim 40, wherein the planar guide comprises a mesial planar guide, and the guide control module generates the mesial planar guide and a distal planar guide parallel to a midsagittal plane of the orthodontic appliance.

Claim 45 (Original): The system of claim 44, wherein the guide control module generates the mesial planar guide and the distal planar guide parallel to and equidistant from the midsagittal plane of the orthodontic appliance.

Claim 46 (Original): The system of claim 40, wherein the planar guide comprises an occlusal planar guide, and the guide control module locates the occlusal planar guide within the 3D environment parallel to a midlateral plane of the orthodontic appliance and proximate an occlusal surface of the tooth.

Claim 47 (Original): The system of claim 40, wherein the planar guide comprises a midlateral planar guide, and the guide control module locates the midlateral planar guide parallel to a midlateral plane of the appliance.

Claim 48 (Original): The system of claim 40, wherein the planar guide comprises a midfrontal planar guide, and the guide control module generates the midfrontal planar guide parallel to a midfrontal plane of the orthodontic appliance within the 3D environment.

Claim 49 (Original): The system of claim 40, wherein the planar guide comprises a midsagittal planar guide, and the guide control module generates the midsagittal planar guide parallel to a midsagittal plane of the orthodontic appliance.

Claim 50 (Original): The system of claim 40, wherein the planar guide comprises a gingival planar guide, and displaying a planar guide further comprises rendering the gingival planar guide parallel to a midlateral plane of the orthodontic appliance and proximate a gingival edge of the tooth.

Claim 51 (Original): The system of claim 39, wherein the user interface displays the planar guide as a semi-transparent two-dimensional plane within the 3D environment.

Claim 52 (Original): The system of claim 39, wherein the user interface displays the planar guide as a partial plane comprising at least two lines.

Claim 53 (Original): The system of claim 40, further comprising:

a database to store data that describes attributes for types of orthodontic appliances that may be selected by the practitioner, and

wherein the guide control module controls the location of the planar guide based on the stored attributes.

Claim 54 (Original): The system of claim 53, wherein the database is located remote from the computing device and coupled to the computing device via a network.

Claim 55 (Original): The system of claim 53, wherein the attributes comprise one or more of dimensions, slot locations, torque angles, and angulations for the types of orthodontic appliances.

Claim 56 (Original): The system of claim 40, further comprising:

a database that stores planar guide data that specifies types of planar guides,

wherein the user interface receives input from the practitioner enabling the display of at least one or more of the types of planar guides, and the guide control module controls the planar guide within the 3D environment in accordance with the selected one or more types of planar guides.

Claim 57 (Original): The system of claim 40, further comprising:

a database that stores planar guide data that describes attributes for different types of planar guides, and

wherein the guide control module controls the planar guide within the 3D environment in accordance with the stored attributes for the different types of planar guides.

Claim 58 (Original): The system of claim 57, wherein the database stores attributes for the different types of planar guides with respect to different types of orthodontic appliances.

Claim 59 (Original): The system of claim 57, wherein the database stores attributes for the different types of planar guides with respect to different types of teeth within the dental arch.

Claim 60 (Original): The system of claim 57, wherein the database stores attributes that specify distances for each of the different types of planar guides with respect to at least one of a tooth of the dental arch, a different one of the planar guides, and the orthodontic appliance.

Claim 61 (Original): The system of claim 57, wherein the database stores attributes that specify shear angles and scales for the different types of planar guides.

Claim 62 (Original): The system of claim 40, wherein the guide control module automatically scales the planar guide within the 3D environment to size the planar guide based on one or more dimensions of a tooth within the dental arch.

Claim 63 (Original): The system of claim 40, wherein the guide control module automatically shears the planar guide in accordance with a shear factor that is based on an angulation associated with the orthodontic appliance.

Claim 64 (Original): The system of claim 40, wherein the guide control module automatically shears the planar guide in accordance with an angle of the orthodontic appliance relative to an occlusal-gingival axis of the orthodontic appliance.

Claim 65 (Original): The system of claim 40, further comprising

a database that stores data defining one or more rules for placing the orthodontic appliance, and

wherein the guide control module controls the planar guide within the 3D environment in accordance with the placement rules.

Claim 66 (Original): The system of claim 65, wherein the guide control module automatically renders the planar guide within the 3D environment as parallel to a midsagittal plane of the orthodontic appliance in response to one of the placement rules that requires a longitudinal axis or an occlusal-gingival axis of the orthodontic appliance be aligned with the midsagittal plane of the tooth.

Claim 67 (Original): The system of claim 40, further comprising:

a database that stores statistical normal distances for one or more dimensions of teeth, and wherein the guide control module controls the location of the planar guide within the 3D environment based on the statistical normal distances.

Claim 68 (Original): The system of claim 40, wherein the user interface receives input biasing the planar guide relative to the statistical normal distance, and the guide control module adjusts the location for the planar guide based on the input.

Claim 69 (Original): The system of claim 39, wherein the user interface displays visual reference markers relative to the planar guide at discrete intervals.

Claim 70 (Original): The system of claim 69, wherein the user interface displays the visual reference markers as a rectilinear grid of semi-transparent lines on the planar guide.

Claim 71 (Original): The system of claim 69, wherein the user interface displays the visual reference markers as points, crosshairs, tic marks, discs, squares, or spheres at the discrete intervals.

Claim 72 (Original): The system of claim 69, wherein the user interface displays the visual reference markers throughout a volume bounded by the planar guide and at least one other planar guide.

Claim 73 (Original): The system of claim 39, wherein the user interface displays contour lines on the planar guide, wherein each contour line indicates a constant distance to an object within the 3D environment relative to the planar guide.

Claim 74 (Original): The system of claim 39, wherein the orthodontic appliance comprises an orthodontic bracket, a buccal tube, a sheath, a button or an arch wire.

Claim 75 (Currently Amended): A computer-readable medium comprising instructions for causing a programmable processor to:

render a digital representation of a tooth within a three-dimensional (3D) environment;

~~computes a location of a planar guide based on a placement of an orthodontic appliance within the 3D environment relative to the dental arch;~~ and

display ~~the~~ a planar guide ~~at the computed location~~ within the 3D environment as a visual aid to a practitioner in ~~adjusting~~ the placement of an orthodontic appliance relative to the tooth within the 3D environment, by rendering the planar guide at a location based on a position of the orthodontic appliance within the 3D environment.

Claim 76 (Original): The computer-readable medium of claim 75, wherein the instructions cause the processor to:

associate a coordinate system with the orthodontic appliance within the 3D environment, and

generate the planar guide within the 3D environment relative to the coordinate system associated with the orthodontic appliance.

Claim 77 (Previously Presented): The computer-readable medium of claim 75, wherein the instructions cause the processor to automatically adjust a location and an orientation of the planar guide within the 3D environment as the practitioner adjusts the placement of the orthodontic appliance with respect to the tooth within the 3D environment.

Claim 78 (Original): The computer-readable medium of claim 75, wherein the instructions cause the processor to display the planar guide as one of:

a mesial planar guide or a distal planar guide parallel to and optionally equidistant from a midsagittal plane of the orthodontic appliance,

an occlusal planar guide parallel to a midlateral plane of the orthodontic appliance and proximate an occlusal surface of the tooth,

a gingival planar guide parallel to a gingival edge of the orthodontic appliance,

a midlateral planar guide parallel to a midlateral plane of the orthodontic appliance,

a midfrontal planar guide parallel to a midfrontal plane of the orthodontic appliance, and

a midsagittal planar guide parallel to a midsagittal plane of the orthodontic appliance.

Claim 79 (Original): The computer-readable medium of claim 75, wherein the instructions cause the processor to:

store data defining one or more rules for placing the orthodontic appliance; and

control the planar guide to assist the practitioner in positioning the orthodontic appliance in accordance with the placement rules.

Claim 80 (Previously Presented): The method of claim 1, further comprising computing an orientation of the planar guide based on the placement of the orthodontic appliance within the 3D environment relative to the dental arch.

Claim 81 (Previously Presented): The system of claim 39, wherein the guide control module further computes an orientation of the planar guide based on the placement of the orthodontic appliance within the 3D environment relative to the dental arch.

Claim 82 (Previously Presented): The computer-readable medium of claim 75, wherein the instructions cause the processor to compute an orientation of the planar guide based on the placement of the orthodontic appliance within the 3D environment relative to the dental arch.